1998/99 Annual Combined Sewer Overflow Report

King County Department of Natural Resources
Wastewater Treatment Division

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King County
Department of Natural Resources

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1.1 Introduction

This report is prepared and submitted to the Department of Ecology (Ecology) in accordance with the requirements established within NPDES Permits WA-002918-1 and WA-002901-7 and WAC 173-245-090. As outlined in the WAC, this report includes:

- An overview and status of King County Department of Natural Resources, Wastewater Treatment Division's (WTD's) CSO Control Program
- 1998/99 overflow volume and frequency information
- An overview of King County WTD's CSO Monitoring Program

1.2 Background

King County WTD provides wholesale wastewater conveyance and treatment for flows from the City of Seattle and thirty-five other cities and sewer districts. The City of Seattle collection system contains combined sewers that collect both sanitary sewage and stormwater. Seattle's wastewater collection system conveys flow to County trunks and interceptors which then convey flows to the County's West Point treatment plant located off West Point in Discovery Park. When storm events occur, flows may exceed the capacity of the collection system pipes, resulting in combined sewer overflows (CSOs) into Lake Washington, Lake Union, the Ship Canal, the Duwamish River, and Elliott Bay and Puget Sound (Figure 1-1). CSOs are a recognized source of water pollution that can result in aesthetic degradation of shorelines during CSO events and impact sediment quality at discharge points. CSOs may raise public health concerns in areas where there is potential for public contact.

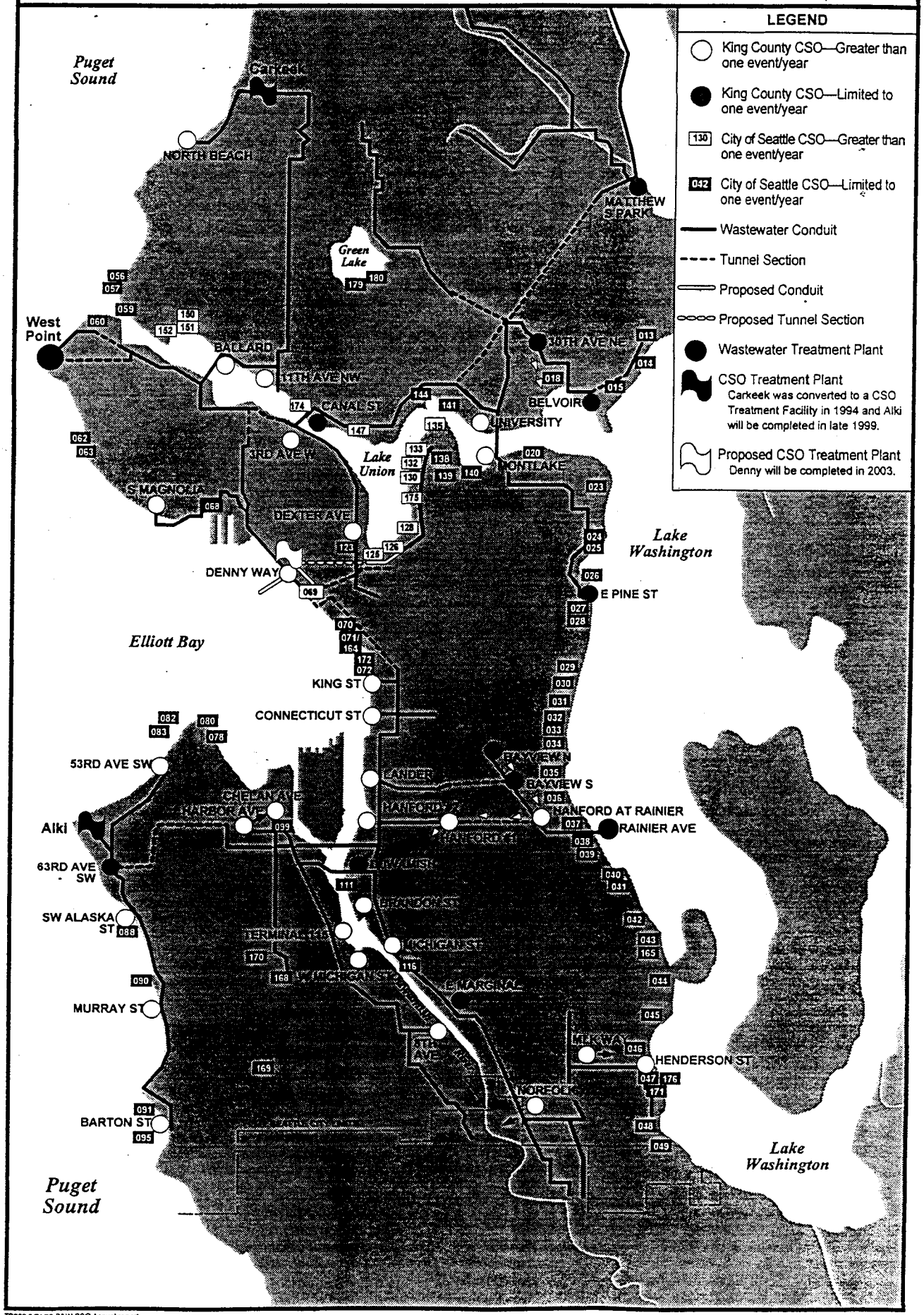
Since the 1960s, King County has been conducting CSO control projects to improve water quality in the Seattle-King County area. The County first formalized its CSO control program with the development of its *1979 CSO Control Program (1979 Program)*. The *1979 Program* identified nine projects to control CSO events into fresh water areas (i.e., Lake Washington, Lake Union, and the Ship Canal).

In 1985, new regulations were introduced with the Washington State Water Pollution Control Act (RCW 90.48) requiring all municipalities with CSOs to develop plans for "...the greatest reasonable reduction at the earliest possible date." The County's *1986 Plan for Secondary Treatment Facilities and Combined Sewer Overflow Control (1986 Plan)* met this state requirement.

Before the *1986 Plan* was implemented, new regulations were promulgated by Ecology. The new regulations (WAC 173-245-020) defined "greatest reasonable reduction" to mean, "control of each CSO such that an average of one untreated discharge may occur per year." The County worked with Ecology to develop an interim goal of 75 percent reduction of CSO volumes systemwide by the end of 2005. The County's *Final 1988*

Figure 1-1

Combined Sewer Overflow (CSO) Map



Combined Sewer Overflow Control Plan (1988 Plan) identified eleven CSO control projects designed to meet this interim goal.

As part of the renewal process for the West Point treatment plant NPDES permit, King County prepared an update/amendment to the *1988 Plan*. The *1995 CSO Update* included an assessment of the effectiveness of CSO reduction efforts to date, a re-evaluation of priority for CSO sites, and a list of projects for the next five years.

In November 1996, King County WTD renegotiated the requirement to reduce CSO discharges by 75 percent system-wide by 2005. This requirement was waived and King County – WTD, working with Ecology, identified an approach that would allow control of CSOs along public access areas and bathing beaches sooner than under the previous agreement.

Regional Wastewater Services Plan

The *Metropolitan Seattle Sewerage and Drainage Survey* was prepared in 1958 to guide a long-range program of sewerage and drainage services for the Seattle area. That first comprehensive planning document was intended to provide a concise, up-to-date, central source of information concerning King County's long-range plans. Since that time, numerous amendments have been made to the original comprehensive plan.

King County's CSO planning is one component of WTD's current long-range wastewater planning effort, the *Regional Wastewater Services Plan (RWSP)*. The *RWSP* will be an amendment to the *Metropolitan Seattle Sewerage and Drainage Survey* that will integrate long-range planning in all areas of wastewater services, including treatment and conveyance, biosolids management, CSO control, and water reuse. The *RWSP* planning process will establish the priorities for all wastewater programs, including those that affect CSO controls. The *Draft RWSP* was issued in May 1997. The Metropolitan King County Executive issued a report describing the Executive's preferred alternative in April 1998. The King County Council is expected to adopt a Final Plan and final Environmental Impact Statement (EIS) in late 1999. All CSO projects defined by the *RWSP* will be included in the year *2000 CSO Plan Update*, including project descriptions and schedules for project completion.

1.3 Status of CSO Control Projects

1.3.1 CSO Control Projects from the 1988 Plan

The *1988 Plan* identified several CSO control projects that King County would undertake through late 2005 to meet the interim goal of 75 percent reduction of CSO volumes systemwide. Table 1-1 summarizes *1988 Plan* projects that have been completed. Table 1-2 summarizes projects from the *1988 Plan* that are in progress or have been modified since the *1988 Plan* was issued. Project descriptions for modified projects or projects underway are also provided.

Table 1-1. Completed Projects from the *1988 Plan*

Project	Year Started	Year Completed
Hanford Separation	1986	1987
Lander Separation/Bayview tunnel	1986	1992
Fort Lawton Parallel Tunnel	1987	1991
University Regulator (Densmore Diversion)	1986	1994
Carkeek Transfer/CSO Treatment Plant	1988	1994
Alki Transfer/CSO Treatment Plant	1989	1998

Table 1-2. Other Projects from the *1988 Plan*

Project	Year to Start	Year to be Completed
CATAD Modifications	1987	Ongoing
Denny Way CSO Control	1993	2003[a]
Kingdome/Industrial Area Storage and Separation	2000	RWSP[b]
Michigan Street Separation	1997	RWSP[b]
Diagonal Separation	1995	City of Seattle project

[a] Delayed and modified as discussed in text. See pages 4 and 8.

[b] Project modified in the RWSP.

1.3.1.1 CATAD Modifications

The Computer Augmented Treatment and Disposal System (CATAD) controls the West Point treatment plant collection system. A new control program for the CATAD system was developed and brought on line in 1992 to improve utilization of storage capacity in existing sewers. The new control program included 3 components:

1) Raising storage levels behind regulator stations;
2) Lowering the wet well level at Interbay Pumping Station when rainfall was detected upstream, moving flow to West Point Treatment Plant sooner and vacating valuable storage space in the interceptor; and
3) Incorporating an optimization program (Predictive Control), which monitors rainfall and conditions in the major trunks and interceptors, predicts inflows to the sewer system, and optimizes the regulation of flow through the regulators to minimize CSOs.

These modifications to the system have been estimated to reduce CSO volumes by 150 MG per year, when all are operating as designed.

All three elements of the project were completed. However, problems at Interbay Pump Station and with the computer hardware at West Point prevent the use of the second and third components. Improvements to the Interbay Pump Station are underway to ensure consistent successful operation of the pump station in "CSO mode" (lowering the wet well operating level) during storm events without entraining air into the pumps. Computer hardware and system software upgrades are being scheduled, which will enable operation of the "Predictive Control Program". Modifications to the Predictive Control program are continually needed to incorporate new flow transfer projects and to improve the efficiency and robustness of the optimization program.

1.3.1.2 Alki Transfer/CSO Treatment Plant & 63rd Ave P.S. CSO

Design for the Alki project began in 1989 and construction will be completed in 1999. Flow transfer occurred in 1998. Specific permit conditions for operation of the Alki facility are being negotiated as part of the West Point permit with Ecology.

The Alki project is designed to transfer flows up to 18.9 mgd from the Alki drainage basin to the West Point treatment plant for secondary treatment. During storm events, combined sewer flows above 18.9 mgd, up to a maximum of 55 mgd, will receive primary treatment and disinfection at a modified Alki plant with discharge through the existing outfall. In order to protect the treatment facility, flows in excess of 55 mgd (estimated to occur, on average, about once per year) will be discharged via the 63rd Avenue pump station outfall, which is a permitted CSO location. The 63rd Avenue pump station CSO has been controlled to the one year standard as part of this project.

A new tunnel and West Seattle pump station provides conveyance of Alki flows to the Elliott Bay Interceptor (EBI) and West Point treatment plant. To avoid exacerbating CSOs in the West Division treatment plant system due to the addition of Alki flows, pipelines were constructed in 1995-96 to transfer at least 18.9 mgd of CSO flows from the southern part of the West Point treatment plant service area to the East Section Reclamation Plant at Renton via the Allentown trunk and Interurban pump station.

A pipeline to convey Harbor regulator station CSO's to the new West Seattle tunnel for storage and control to one event per year was added to this project and will function as designed after the Alki CSO treatment facility comes on line as discussed later in this report (see Section 1.3.2.2).

1.3.1.3 Denny Way CSO Control Project

The *1986 Plan* identified a storage and treatment approach to controlling Denny Way overflows. In the *1988 Plan*, the Denny Way project was changed to include partial separation of 584 acres in the Denny/Lake Union and Denny Local drainage basins. Predesign for the project was scheduled to begin in 1993 with construction ending in 1999.

In late 1991, the Seattle Public Utilities (formerly Seattle Drainage and Wastewater Utility) requested that King County participate in a joint analysis of CSO alternatives to control discharges into Lake Union from Seattle's system and into Elliott Bay from the County's system at the Denny Way regulator station. In 1992, a joint Denny Way/Lake Union CSO Control Project was submitted as a candidate for Federal Infrastructure Grant funds. During 1994, a specific joint City of Seattle/King County, Denny Way/Lake Union CSO Control project was developed, and a $35 million Infrastructure Grant was awarded by the Environmental Protection Agency. This joint project is discussed later in this report. The project is currently in design construction expected to be complete in 2003. (See Section 1.3.2.1).

1.3.1.4 Kingdome/Industrial Area Storage and Separation Project

Under the 1988 Plan, the Kingdome/Industrial Basin was identified as an area for partial separation of CSOs scheduled to be completed by the year 2006.

The Kingdome Separation Predesign report was completed in October 1991. The predesign report studied five different levels of sewer separation. Each separation level required an associated storage component to achieve the goal of one event per year.

The recommended alternative was to construct the Level 2 separation (128.5 acres) and an 11.2 MG storage tank. The total cost of the alternative was $25.7 million (1991 dollars).

Because the one per year CSO improvements were not scheduled until the year 2006, the report recommended deferring the storage tank until after the year 2000. The near term recommendation was to construct the Level 1 separation and 3,050 linear feet (lf) of 96-inch trunk (extending from Alaskan way to Airport Way) prior to road widening.

In 1993-94, the County constructed approximately half of the 96-inch trunk line (1500 lf), extending from Alaskan Way to Third Avenue South. No actual separation work was done at that time, although laterals were placed so separation could occur at a later date. The 96-inch pipe has since functioned as a storage tank and is estimated to reduce CSOs by 12 MG per year.

In November 1995, the Washington State Legislature authorized funding for construction of a new professional baseball stadium. The Washington State Major League Baseball Stadium Public Facilities District (PFD) was formed to administer the project. Design of the project began in early 1996. King County staff began working closely with the PFD's engineers to resolve significant utilities issues created by the location of the stadium directly over the Elliott Bay Interceptor (EBI).

In 1999, the PFD completed 60% of the Level 1 separation between Alaskan Way and Third Avenue South. The PFD constructed the necessary diversion and overflow structures to allow the existing 72-inch combined sewer pipeline to be converted to a separate storm sewer from Third Avenue to Elliott Bay. The system is now in operation.

In addition to the baseball stadium, a new football stadium will be built north of Royal Brougham, and the Washington Department of Transportation (DOT) has proposed a new freeway access ramps on Royal Brougham and Atlantic Streets. The spur in new construction is an impetus to again look at the Kingdome Separation Project to see if additional opportunities for separation exist. Current plans are for both the football stadium and DOT projects to discharge into the separated system.

With the Kingdome separation work already initiated by PFD and DOT, 78 acres of the original 128.5 acres identified in the 1991 report has been separated.

1.3.1.5 Michigan Street Separation Project

The Michigan project, as described in the *1988 Plan*, included total separation in the Michigan basin. The project was scheduled for completion by the end of 2005. The predesign effort for the Michigan project was accelerated to 1992 in conjunction with work being undertaken by the DOT to upgrade the First Avenue South bridge. The predesign report showed that DOT upgrade of the First Avenue South bridge would not impact the Michigan Street CSO project.

Recent County analysis for the *RWSP* indicates that CSO control at Michigan would be best achieved via on-site CSO treatment. The schedule for implementation of a Michigan project is 2022 in the *Executive's Preferred Plan* issued in April 1998. This could change pending council approval.

1.3.1.6 Diagonal Separation Project

In the *1988 Plan*, the Diagonal storage/separation project was identified as a City of Seattle project and not as a County project. The Diagonal project would provide total separation of sanitary and storm drainage by installing new sewers in about 720 acres of combined or partially-separated industrial area. The project would compliment the City of Seattle's project that separated areas adjacent to the County's Duwamish pump station.

1.3.2 1995 CSO Update Projects

In the *1995 CSO Update*, two new projects for CSO control were identified, as a result of more accurate modeling information. The projects are discussed in the *1995 CSO Update* and are as follows:

- Harbor CSO Pipeline Project
- Henderson/Martin Luther King Jr. Way CSO Control Project

The revised Denny Way project, the Harbor CSO Pipeline Project and the Henderson/Martin Luther King Jr. Way CSO Control Project formed the basis of the CSO Control Program for the next three years. Construction for the North Beach project is scheduled to be complete in 2011, and Brandon project construction is scheduled for completion in 2022 as listed in the *Executive's Preferred Plan*. The projects are described below.

1.3.2.1 Denny Way/Lake Union CSO Control Project

As discussed in Section 1.3.1.3, the Denny Way/Lake Union CSO Control Project was identified in 1994 as a joint project for King County and the City of Seattle. The City completed construction of Phase 1 in 1997; a project to increase wet-weather capacity in the east and south Lake Union areas. The City's Phase 2 project will connect the Phase 1 facilities to the County's Phases 3 and 4 facilities.

Phase 3 and 4 of the project will control Lake Union and Denny Way CSOs by 1) storing CSO flows during moderate storms and transferring them to the West Point treatment plant after the storm subsides; and 2) providing on-site treatment at the Elliott West site with discharge of treated flows through a new outfall during heavy rain conditions. Facilities include:

- a 6,200 ft. long tunnel under Mercer Street between Dexter Avenue North and Elliott Avenue West (for CSO storage and conveyance)
- CSO control facilities at the Elliott West site (with floatable removal, disinfection, and dechlorination)
- piping and regulators to convey CSO flows from the existing County sewer system to the new facilities
- an outfall into Elliott Bay at Myrtle Edwards Park (to discharge treated flows from the Elliott West facilities)
- an extension of the existing outfall at the Denny regulator at Myrtle Edwards Park (to discharge untreated CSO flows, expected to occur about once per year)

A general milestone schedule for project implementation is shown below:

Preliminary Design Began	Spring 1997
Facilities Plan Submitted to Ecology	Spring 1998
Final Design Began	Fall 1998
Construction Begins	2000
Construction Complete	2003

A joint final State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS)/National Environmental Policy Act (NEPA) Environmental Assessment for Phases 2 and 3/4 was issued in July 1998. Construction of the City and County projects are scheduled to be completed by the end of 2003.

1.3.2.2 Harbor CSO Pipeline Project

The Harbor CSO Pipeline Project will convey overflows from the Harbor Regulator to the new West Seattle pump station for storage in the new West Seattle Tunnel, controlling CSO events at the Harbor regulator station to one event per year or less. This is a change from the *1988 Plan* which recommended partial separation to control Harbor CSOs. The project was revised when County modeling indicated that partial separation would not control Harbor CSOs to the one event per year level, requiring the addition of storage. The availability of nearby storage in the West Seattle Tunnel made the Harbor CSO Pipeline a cost-effective alternative.

The current Harbor project was re-prioritized to be completed sooner than scheduled in the *1988 Plan* due to the cost and environmental benefits from constructing the pipeline concurrently with the Alki Project's West Seattle forcemain. The Harbor pipeline portion of the project enlarged the trench for the forcemain and laid a new 54-inch pipe underneath. The cost of the current Harbor project was much less than the cost of excavating a new pipeline and trench for the 54-inch pipe. Risk of affecting the integrity of the forcemain by future construction was also avoided.

The Alki Project's West Seattle Forcemain contract was completed in 1996. CSOs from the Harbor Regulator will be stored in the tunnel beginning in 2000 after the Alki CSO Treatment Plant modifications are complete.

1.3.2.3 Henderson/Martin Luther King Jr. Way CSO Control Project

At the time of adoption of the *1988 Plan*, the County believed that all CSOs into Lake Washington, including the discharge from the Henderson Street pump station and Martin Luther King Jr. Way overflow weirs, had been controlled to the one event per year level. However, subsequent monitoring data indicated that overflows occurred more frequently than once per year at these locations.

As a result, in 1995 the County developed an engineering evaluation of the basin tributary to the Henderson/Martin Luther King Jr. Way CSOs to determine the sources and causes of the overflows at these locations, and identified interim and permanent corrective measures to control overflows. The evaluation also considered the impact of these measures on the downstream Norfolk regulator station. Based on this evaluation, the recommended alternative was to construct a 3.2-MG storage tank/CSO treatment facility near the Norfolk regulator station along with associated conveyance and pumping improvements.

In 1997, King County began predesign work on the Henderson/Martin Luther King Jr. Project. During evaluation of alternatives, it was determined that a storage/treatment tunnel was more cost effective than the storage/treatment tank alternative. In addition, the storage tunnel had a conveyance system benefit, lower O&M, less adverse community impacts and was more consistent with the approach being used on other CSO projects. Therefore, the storage/treatment tunnel emerged from predesign as the preferred alternative.

The Project elements and construction schedule are as follows:

	Construction Begins	Construction Complete
♦ Forcemain	June 2000	June 2001
♦ Tunnel Overflow Pipe	June 2000	June 2001
♦ Tunnel	June 2000	December 2002
♦ Henderson Pump Station	June 2000	December 2002

1.3.2.4 North Beach Storage/Pump Station Upgrade

King County believed in 1988 that overflows from the North Beach pump station had been controlled to one event per year. However, during predesign for the Carkeek Park CSO treatment plant, overflows exceeding one event per year were identified at North Beach. As a result, the County initiated a predesign effort to control these overflows and a report was completed in July 1993. The report recommended construction of a new storage basin at the pump station site, an increase in pump station capacity, and construction of a new pipeline in Carkeek Park to reroute flows from two City of Seattle gravity sewer lines that discharge directly to the County's forcemain. In the *Executive's Preferred Plan*, this project would be in service by 2011.

1.3.2.5 Brandon Separation Project

During predesign of the Michigan Separation project, the predesign team recommended the addition of a Brandon partial separation and storage project. Recent County modeling for the *RWSP* indicates that CSO control at Brandon would be best achieved via on-site CSO treatment. The schedule for implementation of a Brandon project is 2022 in the *Executive's Preferred Plan.*

1.3.3 Other Related Projects

1.3.3.1 King County's Water Quality Assessment

To gain a better understanding of CSO impacts in Elliott Bay and the Duwamish River, King County has completed a CSO water quality assessment (WQA).

The CSO WQA was designed to:

- Determine existing conditions in Elliott Bay and the Duwamish River by sampling, monitoring, and computer modeling the water column and sediments.
- Understand the relative significance of CSO pollutants compared to other pollutant sources by studying CSO impacts on human health and aquatic life.

The overall findings of the study are:

- There is clear evidence of potential risks to aquatic life, wildlife, and people both under existing conditions and without CSOs.
- The primary source of risks to humans and wildlife from chemicals are due to historically contaminated sediments.
- There may be some risks to humans 6 to 24 hrs after a CSO event from elevated levels of pathogens and viruses in the water column.

The final report for the CSO Water Quality Assessment has been completed and is posted in its entirety on the web page http://splash.metrokc.gov/wlr/waterres/wqa/wqpage.htm

1.3.3.2 Lander and Densmore Stormwater Management Program

King County and the City of Seattle are jointly undertaking a stormwater management program in the Lander and Densmore drainage basins as required by the NPDES municipal stormwater permit. This is an on-going program that includes the following elements: source control, baseline sampling of stormwater discharges, surveys, and inspections. The maintenance of the stormwater system, the development of compliance schedules and enforcement actions are to be managed by the City of Seattle as specified in an Interlocal Agreement by and between the City of Seattle and King County.

1.3.3.3 CSO Notification Program

In order to meet state and federal requirements for public notification and to provide information to the community regarding the possible health impacts of CSOs, King County Department of Natural Resources (KCDNR), the Seattle-King County Health Department (SKCHD) and the City of Seattle Public Utilities (SPU) have collaborated on the development of a CSO Public Notification/Posting Program. This program includes posting warning signs at King County and City of Seattle CSOs, an information phone number for the public to contact the Seattle-King County Health Department (SKCHD) on questions concerning CSOs, a brochure, website, and other outreach efforts.

The CSO signs include a graphic, some text, the SKCHD information phone number, as well as a CSO number assigned to each site, which corresponds to its NPDES identifier number.

Ecology was briefed on the program and accepted its development and components. A report detailing the development of the program and its' elements is being produced and should be completed by Fall 1999.

Included in Appendix A are CSO Quarterly Reports from SKCHD detailing information requested from the information line.

Section 2 - 1998/99 CSO Volume and Frequency Summary

2.1 Introduction

The County's CATAD System monitors the volume and frequency of CSOs at regulator and pump stations in the West Point treatment plant system. Figure 1-1 at the front of this report shows the location of existing King County and City of Seattle CSO discharges. The area south of the Ship Canal is referred to as the Southern Service Area, and the area north of the Ship Canal is referred to as the Northern Service Area (with the exception of the Montlake and Dexter regulator station). The County deploys portable flowmeters at the following seven CSO locations not currently monitored by CATAD: Barton, South Magnolia, East Ballard (11th Ave. NW), North Beach, Terminal 115, Martin Luther King Jr. Way, Henderson Street, SW Alaska Street (Beach Drive), and 63rd Ave.

2.2 1998/99 CSO Volumes

The total system overflow volume for the June 1998 through May 1999 reporting period was 1462.3 MG compared to a baseline volume of 2,393 MG. This represents a 39% reduction in volume from 1983.

As shown on Table 2-1, rainfall measured by County rain gauges at pump and regulator stations for the 1998/99 reporting period averaged 40.84 inches. This is 13% above the average rainfall of 36 inches per year.

Table 2-1
1998/99 Rainfall at Pump and Regulator Stations
(in inches)

Station	Jun-98	Jul-98	Aug-98	Sep-98	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	1998/99 Total
Denny Local	1.43	0.67	0.19	0.6	2.89	7.99	6.82	5.87	7.49	3.12	1.13	1.67	39.87
King Street	1.45	0.88	0.18	0.56	2.93	7.61	7.38	6.3	8.09	3.46	1.13	1.59	41.56
Chelan Avenue	1.56	0.2	0.43	0.58	3.24	9.74	6.29	4.52	(1)2.16	(1)2.4	1.61	2.4	(2)30.57
Denny Way Lake Union	1.31	0.68	0.23	0.52	2.68	(1)5.96	5.36	4.23	5.64	(1)2.3	0.91	1.46	(2)23.02
Ballard	1.34	0.77	0.37	0.51	2.62	7.55	6.87	5.71	4.86	(1)35.5	(1)85.2	1.28	(2)31.88
University	1.69	0.77	0.47	0.61	3.84	(1)5.09	7.5	6.88	8.58	4.21	1.85	1.23	(2)37.63
Hollywood	2.05	0.36	0.36	0.97	2.5	(1)3.01	6.54	6.12	6.01	3.75	1.86	1.68	(2)32.2
Rainier Avenue	1.9	0.88	0.55	0.83	2.61	(1)4.95	8.23	6.1	4.56	(1)11.44	(1)3.43	1.86	(2)27.52
East Marginal Way	1.13	0.31	0.7	0.85	2.47	7.46	7.31	6.35	5.73	(1)5.09	1.05	1.55	(2)34.91
Henderson	1.12	0.55	0.41	(1)0.18	2.11	8.86	8.03	6.93	7.2	3.7	(1)31.0	1.95	(2)40.86
East Pine Street	1.53	0.55	0.28	0.95	2.71	8.88	7.37	6.48	7.91	3.58	1.15	1.22	42.61
Matthews Park	1.42	0.37	0.5	0.75	3.94	8.57	7.43	6.25	7.73	3.99	1.9	1.46	43.89
Kenmore	1.25	0.49	0.22	0.84	2.99	(1)3.14	5.97	5.77	7.27	3.9	1.7	2.02	(2)32.42
Average	1.48	0.58	0.38	0.71	2.89	8.33	7.01	5.96	6.72	3.71	1.43	1.64	40.84
Total	19.18	7.48	4.89	8.75	37.53	66.66	91.1	77.51	80.65	80.65	14.29	21.37	458.94

(1) Questionable data not included in total/ average calculation. Malfunctions occurred that caused volumes to be excessively high or low.

(2) Totals does not include questionable data.

Rain gauges at pump and regulator stations were replaced during the reporting period to improve reliability and maintenance requirements. Installation and calibration of the new gauges may have caused the questionable data during the reporting period. However, data quality should improve in future years.

Table 2-2 contains the monthly overflow volumes and comparisons to revised baseline conditions for each station. Figure 2-1 graphically illustrates the relationship between rainfall and CSO volumes.

While the establishment of baseline conditions identifies average annual volume and frequencies of discharge, year-to-year comparisons to baseline conditions can be misleading. Annual rainfall cannot indicate year-to-year variations in CSO volumes for individual basins, as rainfall can be extremely variable throughout the Seattle area. This is illustrated during the reporting period by precipitation being above average for the region. Approximately 40.84 inches of rain was recorded by King County Metro's rain gauges compared with a yearly average of 36 inches. Since 1988 a significant number of CSO control projects have been completed or partially completed. Reduction benefits from Hanford/Bayview/Lander separation, CATAD modifications, and other CSO control projects are reflected in the overflow volumes and frequencies. As other CSO control projects are completed and become operational, greater CSO reductions are expected to occur.

2.2.1 Southern Service Area (SSA)

Overflow volumes in the Southern Service Area for 1998/99 were 1,297 compared to a baseline of 1,921 MG. Due to the increased amount of rainfall during the reporting period, overflow volumes were above baseline at the following SSA station: Denny Way and W. Michigan.

- The Denny Way overflow volume for the reporting period was 585 MG compared to a baseline of 405 MG. The Denny Way overflow represents the total overflow volume from Denny Way/Lake Union regulator station, Denny Way Local regulator station, and Interbay pump station.

- There is a significant operating relationship between the Michigan and Brandon basins, and flows to the EBI from one-basin affects the operation of the regulator gate in the other basin. This may account for unusually high or low volumes and frequencies at either location. An assessment of the total volume at both regulator stations may more accurately reflect volume and frequency reductions. Using this method, Brandon and Michigan experienced overflow volumes of 37.5 MG compared to a baseline of 250 MG.

- When the Hanford #1 separation project was completed in 1987, it was thought that all CSO overflows were eliminated from Hanford #1. However, new monitoring data indicates that CSO events are occurring at the site and these estimated volumes and frequencies are reported in Tables 2-2 and 2-3. The discharge location for Hanford #1 CSOs is the Diagonal storm drain discharge.

- Overflow volumes at Hanford and Lander are below baseline, but higher than last year. Higher than expected overflow volumes at Hanford and Lander may be due to higher than average rainfall. The County will continue to monitor overflows in these locations to identify other potential causes.

2.2.2 Northern Service Area (NSA)

Overflow volumes in the Northern Service Area for 1998/99 were 136 MG compared to a baseline of 353 MG. While there was above average rainfall, the storms tended to be low intensity and continuous.

2.2.3 Carkeek Park CSO Plant

See Section 4.

2.2.4 1998/99 CSO Volumes Compared to Previous Years

Figure 2-2 illustrates the progress King County has made in CSO control; the first column illustrates the baseline volumes with yearly measurements in the subsequent columns. During the 1989/90 and 1990/91 reporting periods, a number of CSO control projects were still under construction and benefits had not yet been realized. Below average rainfall during the 1991/92, 1992/93, and 1993/94 reporting periods resulted in decreased overflow volumes. In recent years, rainfall has been average or above average but CSO volumes remain below baseline overflow volumes. Thus, benefits from completed CSO control projects are now being consistently observed.

Table 2-2
1998/99 CSO Volume Summary by Service Area
(in million gallons)

Station	Jun-98	Jul-98	Aug-98	Sep-98	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	1998/99 Total (MG)	Revised Baseline (MG)
SSA														
Denny Way	4.6	1.4	0.0	3.5	34.0	148.1	155.0	92.8	118.7	24.7	0.7	1.7	585.0	405
King Street	0.0	0.0	0.0	0.2	2.6	13.1	12.9	6.1	12.3	0.1	0.0	0.0	47.1	55
Connecticut	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90
Hanford	0.6	0.0	0.0	2.1	8.2	75.4	115.9	113.8	150.9	34.4	0.0	0.0	501.4	605
Lander II St.	0.0	0.0	0.0	0.0	0.1	36.5	23.9	15.3	17.4	0.2	0.0	0.0	93.4	190
Harbor Ave.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55
Chelan	0.0	0.0	0.0	0.0	0.0	3.3	0.2	0.1	1.9	0.0	0.0	0.0	5.5	65
W. Michigan	0.0	0.0	0.0	0.0	0.0	1.3	0.3	0.0	0.5	0.0	0.0	0.0	2.1	2
8th Ave.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15
Brandon St.	1.3	0.0	1.7	0.3	0.5	16.4	5.0	2.7	4.3	0.2	0.0	0.2	32.6	60
Michigan St.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	4.2	0.0	0.0	0.0	4.9	190
Norfolk St.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70
Duwamish P.S.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Henderson (1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.4	0.0	0.0	0.0	6.7	10
MLK Jr Way (1)	0.2	0.2	0.5	0.7	0.3	22.6	10.2	5.7	3.8	0.0	0.0	0.0	44.1	88
Rainier Ave.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
E. Marginal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
W. Marginal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
S. Magnolia (1)	0.0	0.0	0.0	0.1	0.0	1.8	0.2	0.3	0.3	0.0	0.0	0.0	2.8	15
Terminal 115													N/A	5
SSA SUBTOTAL	6.7	1.6	2.2	6.4	44.8	303.5	318.7	238.6	311.9	59.6	0.7	1.9	1325.7	1921
NSA														
Ballard	0.0	0.9	0.0	0.3	0.5	6.9	0.6	1.1	3.7	0.2	0.0	0.0	14.1	90
Dexter	1.4	1.5	0.0	1.1	5.8	4.0	0.0	0.0	1.8	0.0	0.0	1.4	16.9	15
University	0.0	0.0	0.0	0.7	4.2	48.3	4.4	4.2	30.1	0.0	0.0	0.0	91.8	110
Montlake	0.0	0.0	0.0	1.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	10
Canal St. (Lake City)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Third Ave. W.	0.0	0.0	0.0	0.0	0.2	3.1	0.3	0.1	1.4	0.0	0.0	0.0	5.1	125
E. Pine St.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Belvoir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Matthews Park	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
30th Ave. NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
North Beach (1)	0.0	0.1	0.0	0.3	0.3	1.3	0.3	1.0	3.1	0.0	0.0	0.0	6.0	2
NSA SUBTOTAL	1.4	2.4	0.0	4.0	11.7	63.4	5.6	6.5	40.0	0.2	0.0	1.4	136.5	353
TOTAL	8.1	4.0	2.2	10.4	56.5	366.9	324.0	245.1	351.9	59.8	0.7	3.2	1462.3	2393
ALKI														
Murray													N/A	5
Barton													N/A	7
53rd Ave. SW													N/A	<1
SW Alaska St. (Beach Dr.) (1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12
63rd Ave.													N/A	95
CARKEEK														
Carkeek CSO Plant (2)	0.0	0.0	0.0	0.0	0.0	13.39	15.65	8.26	2.59	2.33	0.0	0.0	42.2	

(1) Portable flow meters; not currently monitored by CATAD.

(2) Carkeek is treated effluent and not included in total.

*Baseline for both CSO frequency and volumes have been revised since the 1988 final CSO Plan due to improvements made to the computer modeling system that provided more accurate projections on historical and future conditions

Figure 2-1. 1998/99 CSO Volume vs. Rainfall

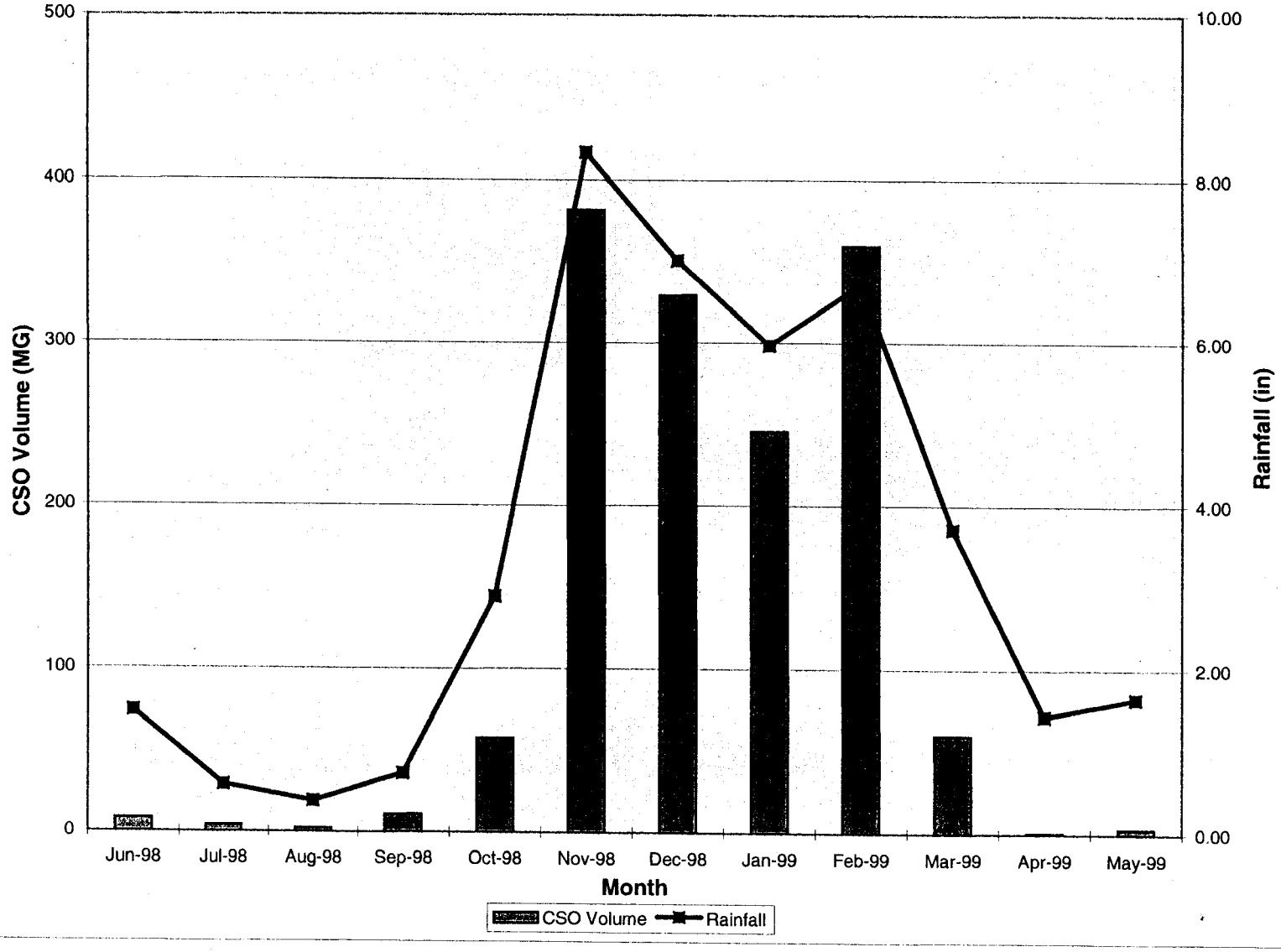
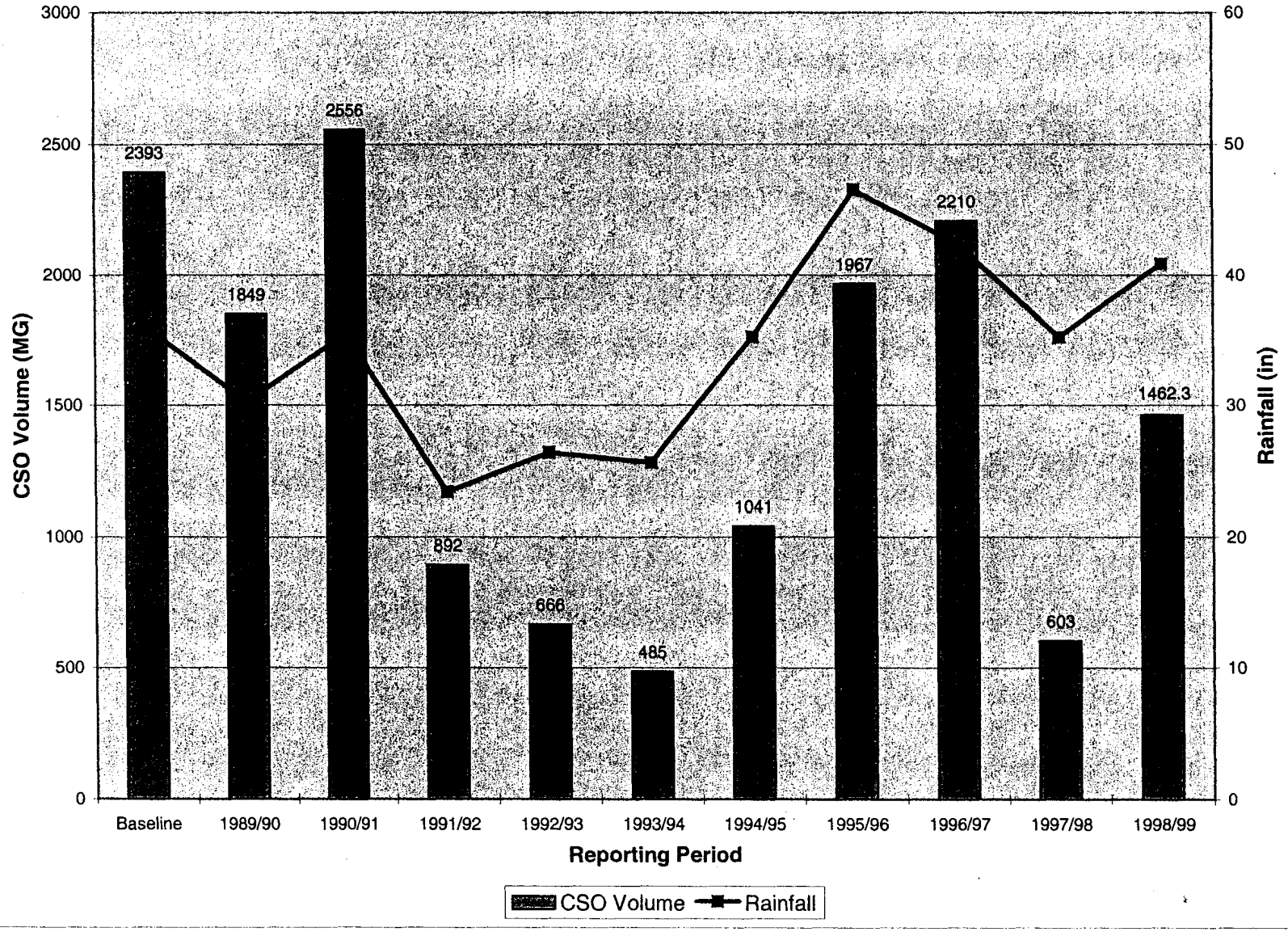


Figure 2-2. Annual CSO Volumes



2.4 1998/99 CSO Frequency of Events

In the 1988 plan, the County defined an overflow event as a period of time during which an overflow was recorded that was preceded by three hours with no rain and followed by three hours without overflows system-wide. Thus, each event was separated by at least three-hours of non-discharge.

Since the *1995 Update* King County has been evaluating the event definition to determine if the original three-hour definition is appropriate based on historical rainfall for the area. Our assumption is that in reporting CSO events, a single independent rainfall event should produce only one CSO event. To check this, a statistical assessment of rainfall and overflows was performed at one of the County's most independent CSOs – Martin Luther King Jr. Way – where it was determined that a forty hour event interval best described the system. The forty hour interval was rounded to forty-eight in order to streamline calculations and to correlate with the forty-eight hour interval set by Ecology in the Carkeek CSO Plant permit language. This assessment was documented in our Task 16.01 Technical Memorandum "CSO Event Definition" by Brown & Caldwell Consulting Engineers, August 30, 1996, and was submitted to Ecology. Since that assessment the County model has been run for both event periods using the years of mid-1978 to mid-1987 and mid-1994 to mid-1996 for simulation. these time periods were selected because the average annual rainfall over these periods is the same as the 36 inches annual average from historical data. The results for both intervals have been reported for comparison purposes in the annual reports.

The modeling results show a significant decrease in number of annual average CSO events using the forty-eight hour interval over the three hour interval. This significant decrease suggests that many of the overflow events occur within a few hours of each other; thus, a single independent rainfall event was inaccurately resulting in a count of multiple CSO events under the old, three hour interval definition.

During the 1998/99 reporting period – using the forty-eight hour interval definition – 248 overflow events were counted, (see Table Table 2-4 and Figure 2-4). Using the older three hour interval definition 396 overflows events were counted compared to the 1983 baseline of 599 events, representing a 33.9% decrease in overflow frequency (see Table 2-3 and Figure 2-3). The County is in the process of creating a baseline for the forty-eight hour definition, which should be included in the year 2000 CSO update report. Under both interval definitions the following CSOs achieved one event or less during 1998/99: E. Pine St., Belvoir, 30th Ave. NE, Matthews Park, Rainier Ave., W. Marginal, W. Marginal, Canal St., and 53rd Ave. SW. A longer term trend will be needed to say that these locations are "controlled".

The County hopes to make a decision on the appropriate event interval definition in the next CSO Plan Update due to Ecology in June 2000. Ecology has recently become interested in this definition and has been meeting with our modelers to discuss the basis of the County's approach. It is our understanding that an Ecology task force is being convened this Fall to develop a state-wide approach. The County will participate as neeeded.

Table 2-3
1998/99 Frequency of CSO Events
(Based on 3 hour non-discharge definition)

Station	Jun-98	Jul-98	Aug-98	Sep-98	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	1998/99 Total	Revised Baseline
SSA													(overflows/yr)	
Denny Way	2	1	0	1	4	9	10	9	14	5	1	1	57	51
King Street	0	0	0	0	2	3	7	4	8	1	0	0	25	31
Connecticut	0	0	0	0	0	0	0	0	0	0	0	0	0	34
Hanford #1 (Hanford@Rainier) (1)	0	0	1	1	3	4	10	1	7	0	0	0	27	
Hanford #2	1	0	0	1	2	6	8	9	10	3	0	0	40	40
Lander II St.	0	0	0	0	1	3	7	5	9	1	0	0	26	29
Harbor Ave.	0	0	0	0	0	0	0	0	0	0	0	0	0	56
Chelan	0	0	0	0	0	1	3	2	3	0	0	0	9	25
W. Michigan	0	0	0	0	0	1	4	0	2	0	0	0	7	9
8th Ave.	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Brandon St.	2	0	2	2	5	10	9	7	10	5	1	4	57	40
Michigan St.	0	0	0	0	0	0	0	2	6	0	0	0	8	40
Norfolk St.	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Duwamish P.S.	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Henderson (1)	0	0	0	0	0	0	0	3	11	3	0	0	17	16
MLK Jr. Way (1)	1	1	1	1	1	3	5	3	2	0	0	0	18	23
Rainier Ave.	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
E. Marginal	0	0	0	0	0	0	0	0	1	0	0	0	1	<1
W. Marginal	0	0	0	0	0	0	0	0	0	0	0	0	0	
S. Magnolia (1)	2	1	0	1	1	5	6	3	4	0	0	0	23	21
Terminal 115													N/A	8
SSA SUBTOTAL	8	3	3	6	16	41	59	47	80	18	2	5	315	447
NSA														
Ballard	0	0	0	0	0	1	0	1	1	0	0	0	3	13
E. Ballard (11th Ave. NW) (1)	0	1	0	2	1	3	1	2	6	2	1	0	19	13
Dexter	1	1	0	1	3	2	1	1	4	0	0	1	15	4
University	0	0	0	1	2	1	3	2	2	0	0	0	11	14
Montlake	0	0	0	1	1	0	0	0	0	0	0	0	2	16
Canal St. (Lake City)	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Third Ave. W.	0	0	0	0	1	1	5	2	5	0	0	0	14	20
E. Pine St.	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Belvoir	0	0	0	0	0	0	0	0	1	0	0	0	1	<1
Matthews Park	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
30th Ave. NE	0	0	0	0	0	0	0	1	0	0	0	0	1	<1
North Beach (1)	0	1	0	1	1	3	3	1	5	0	0	0	15	18
NSA SUBTOTAL	1	3	0	6	9	11	13	10	24	2	1	1	81	98
TOTAL	9	6	3	12	25	52	72	57	104	20	3	6	396	599
ALKI														
Murray													N/A	8
Barton													N/A	23
53rd Ave. SW													N/A	<1
SW Alaska St. (Beach Dr.) (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	23
63rd Ave.													N/A	N/A
CARKEEK														
Carkeek CSO Plant (2)	0	0	0	0	0	1	3	2	2	2	0	0	10	

(1) Portable flow meters; not currently monitored by CATAD.

(2) Carkeek is treated effluent and not included in total.

* Baseline for both CSO frequency and volumes have been revised since the 1988 final CSO Plan due to improvements made to the computer Modeling system that provided more accurate projections on historical and future conditions

Figure 2-3. 1998/99 CSO Events (Based on 3 hr non-discharge) vs. Rainfall

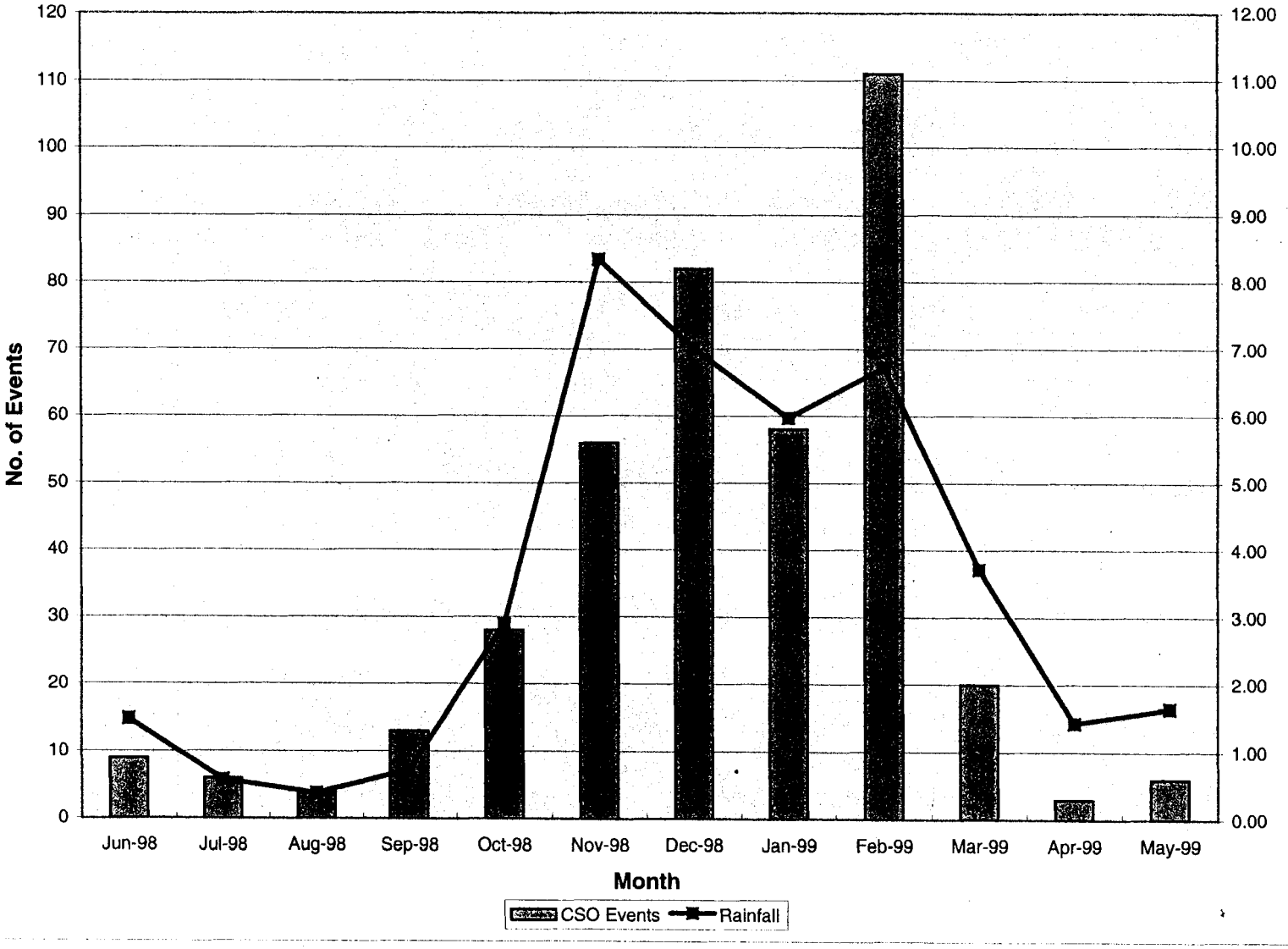
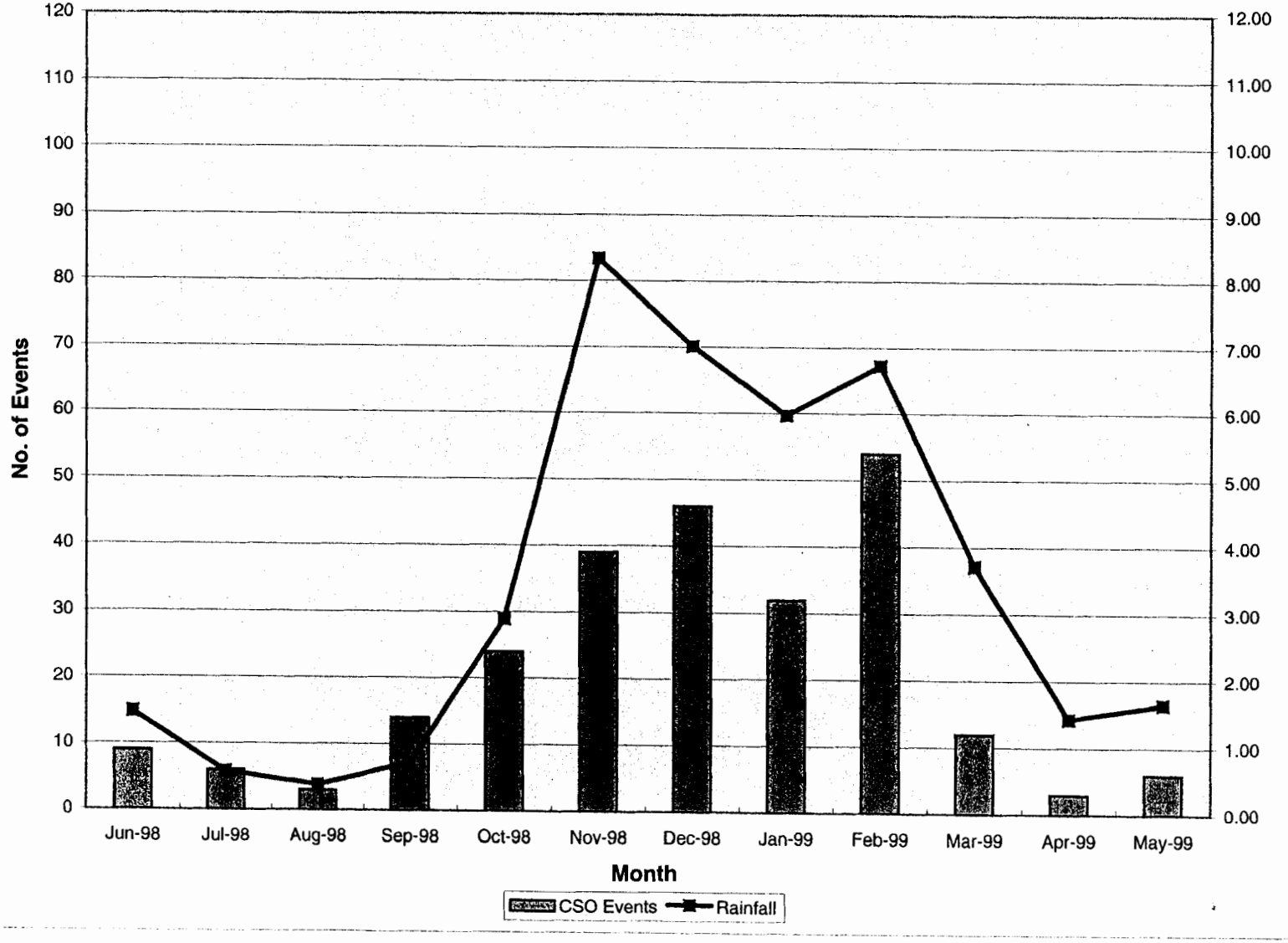


Table 2-4
1998/99 Frequency of CSO Events
(Based on 48 hour non-discharge definition)

Station	Jun-98	Jul-98	Aug-98	Sep-98	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	Total (overflows/yr)
SSA													
Denny Way	2	1	0	1	3	5	4	3	5	2	1	1	28
King Street	0	0	0	1	0	2	3	2	4	1	0	0	13
Connecticut	0	0	0	0	0	0	0	0	0	0	0	0	0
Hanford #1 (Hanford @ Rainier) (1)	0	0	1	1	3	3	5	1	4	0	0	0	18
Hanford #2	1	0	0	1	2	4	4	3	4	2	0	0	21
Lander II St.	0	0	0	0	1	1	4	2	4	1	0	0	13
Harbor Ave.	0	0	0	0	0	0	0	0	0	0	0	0	0
Chelan	0	0	0	0	0	1	3	2	2	0	0	0	8
W. Michigan	0	0	0	0	0	1	2	0	1	0	0	0	4
8th Ave.	0	0	0	0	0	0	0	0	0	0	0	0	0
Brandon St.	2	0	1	2	4	5	5	2	5	3	1	4	34
Michigan St.	0	0	0	0	0	0	0	2	3	0	0	0	5
Norfolk St.	0	0	0	0	0	0	0	0	0	0	0	0	0
Duwamish P.S.	0	0	0	0	0	0	0	0	0	0	0	0	0
Henderson (1)	0	0	0	0	0	0	0	1	3	2	0	0	6
MLK Jr. Way (1)	1	1	1	1	1	3	4	2	1	0	0	0	15
Rainier Ave.	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Marginal	0	0	0	0	0	0	0	0	1	0	0	0	1
W. Marginal	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Magnolia (1)	2	1	0	1	1	4	2	3	2	0	0	0	16
Terminal 115													N/A
SSA SUBTOTAL	8	3	2	7	12	26	31	22	35	11	2	5	182
NSA													
Ballard	0	0	0	0	0	1	0	1	1	0	0	0	3
E. Ballard (11th Ave. NW) (1)	0	1	0	2	1	2	1	2	3	1	1	0	14
Dexter	1	1	0	1	3	2	1	1	2	0	0	1	13
University	0	0	0	1	2	1	3	2	1	0	0	0	10
Montlake	0	0	0	1	1	0	0	0	0	0	0	0	2
Canal St (Lake City)	0	0	0	0	0	0	0	0	0	0	0	0	0
Third Ave. W.	0	0	0	0	1	1	3	1	3	0	0	0	9
E. Pine St.	0	0	0	0	0	0	0	0	0	0	0	0	0
Belvoir	0	0	0	0	0	0	0	0	1	0	0	0	1
Matthews Park	0	0	0	0	0	0	0	0	0	0	0	0	0
30th Ave. NE	0	0	0	0	0	0	0	1	0	0	0	0	1
North Beach (1)	0	1	0	1	1	3	2	1	4	0	0	0	13
NSA SUBTOTAL	1	3	0	6	9	11	10	9	15	1	1	1	66
TOTAL	9	6	2	13	21	36	41	31	50	12	3	6	248
ALKI													
Murray													N/A
Barton													N/A
53rd Ave. SW													N/A
SW Alaska St. (Beach Dr.) (1)	0	0	0	0	0	0	0	0	0	0	0	0	0
63rd Ave.													N/A
CARKEEK													
Carkeek CSO Plant (2)	0	0	0	0	0	1	3	2	2	2	0	0	10

(1) Portable flow meters; not currently monitored by CATAD.
(2) Carkeek is treated effluent and not included in total.

Figure 2-4. 1998/99 CSO Events (Based on 48 hr non-discharge) vs. Rainfall



Section 3 - CSO Monitoring Program

King County's CSO monitoring program includes discharge and sediment sampling of selected CSO sites to meet the requirements of WAC 173-245-040 and conditions in NPDES Permit WA-002918-1. As described in the *1988 Plan*, the County's sampling program was to collect data for five CSO sites per year. Discharge samples were to be taken four times per year under overflow conditions to characterize the CSO effluent at each site. Discharge monitoring requirements were completed in 1995 as shown in Table 3-1.

The *1988 Plan* also provided for sediment samples to be taken at nine CSO sites. These requirements were completed in 1990 as shown in Table 3-2. In addition, the County has developed a comprehensive, site-specific baseline study plan for chemical and biological analysis of the sediment to meet additional NPDES requirements resulting from Washington state's promulgation of sediment standards. This Sediment Baseline Monitoring Plan was completed in October 1997.

3.1.1 Sediment Baseline Monitoring Plan

The sampling program for CSOs is considered complete unless Ecology requires additional information. Plant outfall sampling will occur voluntarily every two years continuously.

- For five sites, a cleanup study was already underway or contemplated in the near future; therefore, no new baseline sampling was proposed.
- For five sites, baseline sampling was complete, and no additional sampling is planned.
- For three sites, cleanup activities were anticipated, and sampling was required to facilitate those activities. As shown on Table 1-3, these sites were initially sampled in 1995, and additional biological and chemical analyses were completed in 1996.
- For three sites, baseline sampling was completed in 1996 (see Table 3-2).
- For four sites, baseline sampling was completed in 1997 (see Table 3-2).

Table 3-1. CSO Discharge Monitoring Program

CSO Location	Serial	Date	Sample #	Status of Program
Michigan Street	W039	03/26/88	8800300	Permit Requirements Met
Lander Street	W030	03/26/88	8800301	Permit Requirements Met
Denny Way	W027	03/25/88	8800302	Permit Requirements Met
11th Ave. NW	W004	02/22/89	8801743	Permit Requirements Met
(E. Ballard)		04/06/88	8800352	
		01/14/88	8800052	
		11/02/88	8802026	
3rd Avenue West	W008	02/22/89	8801742	Permit Requirements Met
(& Ewing Street)		01/14/88	8800053	
		03/26/88	8800303	
		11/02/89	8802027	
Ballard	W003	12/02/89	8909776	Permit Requirements Met
		03/09/90	9000286	
		10/04/90	9000880	
		01/06/90	9000002	
Connecticut Street	W029	08/22/89	8900832	Permit Requirements Met
		10/22/89	8909689	
		04/23/90	9000394	
		02/07/90	9000215	
Brandon Street	W041	03/14/90	9000289	Permit Requirements Met
		06/03/90	9000510	
		10/04/90	9000881	
		12/04/90	9010003	
Norfolk Street	W044	10/14/90	9000887	Permit Requirements Met
		06/06/90	9000524	
		04/03/91	9100612	
		12/04/90	9010006	
W. Michigan Street	W042	01/12/91	9100012	Permit Requirements Met
		04/03/91	9100613	
		01/28/92	9200134	
		10/06/93	L2224-1	
8th Avenue	W040	12/27/94	L5152-1	Permit Requirements Met
Chelan Avenue	W036	10/26/94	L5187-1	Permit Requirements Met
		11/30/94	L5032-1	
		01/31/95	L5357-1	
Dexter Avenue	W009	12/19/94	L5122-1	Permit Requirements Met
		02/18/95	L5494-1	
Montlake	W014	12/04/90	9100009	Permit Requirements Met
		04/03/91	9010609	
		02/21/92	9010006	
		03/23/95	L5766-1	

Table 3-2. CSO Sediment Monitoring Program

CSO Location	Serial	Date	Sample #	Status of Program
Ballard	W003	05/30/89	8900560	Permit Requirements Met
11th Ave. NW (E. Ballard)	W004	05/30/89	8900561	Permit Requirements Met
3rd Ave. W. (& Ewing St.)	W008	05/30/89	8900563	Permit Requirements Met
Dexter Avenue	W009	05/30/89	8900565	Permit Requirements Met
Montlake	W014	05/30/89	8900564	Permit Requirements Met
8th Avenue	W040	05/23/90	9006690	Permit Requirements Met
Brandon Street	W041	05/23/90	9006687	Permit Requirements Met
Michigan Street	W042	05/23/90	9006691	Permit Requirements Met
Hanford	W031	06/27/95-06/29/95	L6393-1 - L6393-11	Permit Requirements Met
Connecticut Street	W029	06/26/95-06/27/95	L6392-1 - L6392-11	Permit Requirements Met
Chelan Avenue	W036	06/28/95-06/29/95	L6397-1 - L6397-6	Permit Requirements Met
Magnolia	W006	10/16/96	L9695-1 - L9695-6	Permit Requirements Met
53rd Avenue SW	W053	10/16/96	L9697-1 - L9697-6	Permit Requirements Met
North Beach	W048	10/15/96	L9696-1 - L9696-6	Permit Requirements Met
SW Alaska Street	W055	10/14/97	L12042-1 L12042-6	Permit Requirements Met
Murray Street	W056	10/14/97 - 10/15/97	L12043-1 L12043-6	Permit Requirements Met
Barton Street	W057	10/15/97	L12044-1 L12044-6	Permit Requirements Met
63rd Street	W054	10/14/97	L12041-1 L12041-6	Permit Requirements Met

Section 4 – Carkeek CSO Plant

This section constitutes the fourth annual report of the Carkeek plant as a CSO facility and summarizes its performance and operation during June 1998 to May 1999. The plant was placed into CSO operation November 1, 1994, under Carkeek's then existing wastewater treatment plant permit. On January 1, 1996, permit limits were changed and included in the West Point permit; subsequent reports reflected these new limitations. Since the last report, the permit has been modified and changes were made effective on July 1, 1998. The following report evaluates the plant's performance against these new limits.

Performance

The Carkeek CSO facility operates under the Washington State Department of Ecology permit number WA-0029181-1 issued to the West Point treatment plant. As of July 1, 1998, the Carkeek effluent limits are defined as follows:

- discharge of suspended solids is limited to a yearly average of events of 60 mg/l or less
- settleable solids will be limited to 1.9 ml/l/ hr or less per event
- settleable solids will be limited to a yearly average of 0.3 ml/ l/hr or less.

During the permit cycle, the number of events per year is limited to an average of 8 and flow is limited to an average of 14 million gallons per year.

Table 4-1. summarizes the plant's monthly operation and performance during 1998. As mentioned above, Settleable Solids (SS) and Total Suspended Solids (TSS) are Carkeek's permit parameters. Analysis of the data shows the plant performed within the permit limitations. The analysis accounts for the dropping of one storm event, i.e. considered the one untreated event per year per the WAC in calculating yearly plant performance. The storm that was excluded occurred in December, beginning on the 12th and ending on the 14th.

A summary of plant performance is shown on spreadsheet 98DOE. Settleable solids and total suspended solids data shown are taken from the monthly Plant Monitoring Reports, (PMRs). Influent and effluent total suspended solids data are monthly averages and event averages respectively. The average total suspended solids removal for the year was 58% and would have been in compliance with old permit requirements. Under the new permit, the TSS requirement was met with an annual event average of 38 mg/l. The settleable solids exception reported in the December PMR is now rescinded as it occurred in the one allowed, untreated event per year. This results in the plant not having a settleable solids exception for 1998.

Operation

Operational procedures have been developed and are being refined to more effectively operate this facility. Quick response in draining process tanks when storms subside resulted in more capacity to receive water if and when storms were to begin again. This effort resulted in a smaller discharge volume and fewer discharge events. Combined meetings with Offsite Operations and West Point Process have worked out more effective

sample handling and chlorination procedures which produced better plant performance and more reliable operating data.

The last in a series of chlorine monitoring modifications was completed this year. In addition to the effluent chlorine monitor, a second chlorine analyzer was installed to monitor chlorine concentrations at an intermediate location in the flow stream immediately following initial injection. Information from this analyzer provides information to West Point where injection rates can be monitored and remotely adjusted when local operator attention is not available. The second analyzer has a much shorter lag time from the hypochlorite injection point and therefore system adjustments to chlorine residual data can be done more quickly.

Modifications were also made to improve the chlorine residual sampling system. The system was redesigned to accommodate constant operation of the chlorine monitoring probes. The probes require conditioning if they are not continuously exposed to varying levels of chlorine. Conditioning the probes was necessary at the start of each storm, but this was too cumbersome and operations staff resorted to using portable colorimetric units for chlorine testing. In the new design, conditioning is maintained by exposing the probes to city water during dry periods when there is no plant flow.

Discussion

The plant operated and performed well, but was negatively impacted by one unusually large storm event – December 12th to December 14th, in which 11.71 MG was received into the plant. This single storm accounted for 21% of the year's flow to the plant. Table A below shows how this storm influenced plant performance. The first line in Table A represents plant performance with all storm data included. The second line represents performance with data for the December storm omitted.

Table A

Time Period	Annual Avg. Effluent TSS Concentration (mg/L)	No. SS exceptions
1/1/98-12/31/98	41	1
Dropping 12/12-12/14 storm data	38	0

The plant continues to receive more flow than anticipated during design and therefore experiences discharges more than the expected 14 MG per year. The City of Seattle and King County are performing Inflow and Infiltration investigations to determine how to proceed with sewer inflow and infiltration problems. Consultants were selected at mid-1999 and are expected to have developed proposals to deal with the problem by early 2000. Implementation of selected proposals is expected by the end of the year 2001.

Table 4-1 Carkeek Annual Report Summary

June 1, 1998 through May 31, 1999

Month	Pump Station Overflow Events Per Month	Plant Discharge Events Per Month	Influent volume Per Month (MG)	Discharge volume Per Month (MG)	Average Influent TSS Per Month (mg/L)	Average Discharge TSS per Event (mg/L)	Average Discharge Settleable Solids per Event (ml/L/hr)	Monthly Discharge Settleable Solids (ml/L/hr)	Max Event Settleable Solids (ml/L/hr)	Total solids out (CP+WP)
Jun-98	0	0	0.00	0.00						0
Jul-98	1	0	0.09	0.00	142				107	15
Aug-98	1	0	0.09	0.00						0
Sep-98	1	0	0.12	0.00	208				208	10
Oct-98	2	0	0.18	0.00	139				209	36
Nov-98	4	1	14.29	13.39	93	40	0.3	0.3	11,074	5,291
Dec-98	4	3	17.50	15.65	89	40, 37, 57	0.3,2.7,<0.1	2.7	13,056	7,331
Jan-99	2	2	10.39	8.26	85	16, 28	<0.1, <0.1	<0.1	7,381	3,956
Feb-99	3	2	27.84	23.55	170	19, 45	<0.1, 0.1	0.1	39,368	7,249
Mar-99	2	2	3.90	2.33	82	22, 25	<0.1, <0.1	<0.1	2,662	740
Apr-99	1	0	0.04	0.00	77				26	3
May-99	1	0	0.02	0.00						0
Year Totals	**22**	**10**	**74.46**	**63.18**					**74,090**	**24,631**
Average Per Year					**121**	**33**	**0.3**			
SS Events Over 1.9 ml/L/hr/ Event				=	**1**					
SS Yearly Average, ml/L/hr				=	**0.3**	**ml/l/hr**				
TSS Yearly Effluent Average, mg/l				=	**33**	**mg/l**				
Adjusted yearly values. (Process data values for the storm of Dec 12 through 14 are omitted in these calculations.)										
Yearly Totals									**64,884**	**18,764**
Average for the Year					**120**	**30**	**0.1**			
Adjusted SS Events Over 1.9 ml/L/hr/ Event				=	**0**	**ml/l/hr**				
Adjusted SS Yearly Average, ml/L/hr				=	**0.1**	**ml/l/hr**				
Adjusted TSS Yearly Effluent Average, mg/l				=	**30**	**mg/l**				

Notes: Details on the above information is provided below.

1) Number of events can be found in the monthly narratives and monthly Plant Monitoring Report (PMR) which come as part of the monthly report packages.
2) Influent and effluent flow volumes are taken from PMRs.
3) TSS and settleable solids data are taken from the PMRs.
4) Calculation of average settleable solids values uses <0.1as =0.0.
5) Flow data is reported daily from 00:00 hours to 23:59 hours.
6) Sample data is taken from 07:00 hours to 0700 hours,
7) CP influent poundage calculation, #s = (flow) x (concentration) x 8.34
8) Total Solids Out (CP+West Point) = (Carkeek pounds out) + (transfer pounds out with WP effluent), and is the pounds TSS discharged to Puget Sound.
9) Dropping data from one storm in Dec., Dec 12, 1998 through Dec 14, 1998 brought the Settleable Solids into compliance for the year.

APPENDIX A
Seattle-King County Dept. of Health
CSO Notification Program Quarterly Report: April – June, 1999

April:

- 3 calls to Information Line:
  - -Request for general information regarding swimming in Lake Washington
  - -Request to move the sign for a construction project (S 171)
  - -Request to remove signs from Green Lake (S 179 & 180)
  - (Referrals to SPU regarding requests to move signs)
- Received comments from work group on draft brochure and poster; forwarded to designer for revisions
- Participated in discussions with colleagues in Seattle and Tacoma re: multicultural outreach opportunities

May:

- 7 calls to Information Line:
  - -Discharge noted at S 137 & 138 last winter, citizen called after sign posted to ask how often this would happen and who is monitoring overflows (referred to SPU)
  - -Request for information about sediment sampling near S 024, and other potential sources of contamination in Lake Washington, i.e., animals
  - -Request for information on health risks from swimming in Seward Park area
  - -Request for information about construction on Elliott Avenue near PI building
  - -Concern that CSOs affect drinking water supply
  - -Concern that contaminants from old landfill near Stan Sayres boat launch seep into Lake Washington and affect water quality
  - -Concern that a pipe on the beach often has some discharge near S 015, near a private swimming beach (map indicates a broken pipe at that location – referred to SPU)
- Received and discussed comments from work group with Public Health colleagues, sent revisions to designer to incorporate in revised brochure and poster
- Presented draft brochure and poster to 3 focus groups (boating safety class, windsurfers, scuba dive instructors)
- Submitted text revisions for CSO website
- Presented information about CSOs to volunteer Beach Naturalist trainees
- Discussed potential collaboration with API/East African youth summer project regarding water quality and health issues, possible use of CSO brochure

June:

- 4 calls to Information Line:
  -Concern that ducklings were trapped at S 144 (retrieved by scuba diver at the caller's business)
  -Tim St. Clair (W. Seattle Herald) request for information on environmental impacts on spawning salmon in Longfellow Creek (referred to SPU)
  -Request for access across SPU easement to private residence for landscaping work (referred to SPU)
  -Request for list of all CSO locations

- Summarized comments from focus testing of draft brochure and poster
- Discussed summary of comments within Public Health, sent revisions to designer
- Sent final revision of brochure and poster to printer
- Continued consultations on website revisions
- Continued discussions with community organizations for potential multicultural outreach

Third Quarter Activity Report: July – September, 1999

July:

- Three calls to Information Line:
  1. There was a concern about swimming near S033,
  2. A SCUBA diver noted brown discharge from hole in side of a pipe near S078 and questioned what was flowing from pipe, including the health risk from swimming through discharge, and
  3. Concern that Lake Washington was closed to swimming due to E. coli (heard from a friend; lives near K018);
- The initial run of 400 brochures and 100 posters were distributed to KC WTD, SPU, Seattle Parks, and Seattle Department of Neighborhoods; and
- A summary of calls exchanged with Derek Sandison for the final report.

August:

- Three calls to Information Line:
  1. Concern about swimming near S078, and
  2. Two calls from Park Rangers at Carkeek and Discovery Parks clarifying CSO status and information in brochures relative to the parks.
- Initial contact was made with the Asian Counseling & Referral Service (ACRS) to explore multicultural outreach possibilities.
- Brochures were sent to a WA SCUBA Alliance representative for their September event.
- A second run of 400 brochures/100 posters was ordered and received.
- We developed a contact list for fall outreach to organizations/retail outlets for water-based activities.

September:

- 2 calls to Information Line:
  1. There was a concern about foam accumulation along eastern Lake Washington shoreline near S037 and Stan Sayres pits, and
  2. A request for information on a residential sewer problem in unincorporated King County.
- Attended a meeting with case managers at ACRS regarding multicultural outreach.
- Had a discussion of outreach at ACRS meal sites with the meal site manager.
- Fall outreach was initiated: sent a mailing to 15 organizations/outlets in Seattle related to water-based activities offering poster and brochure for posting.